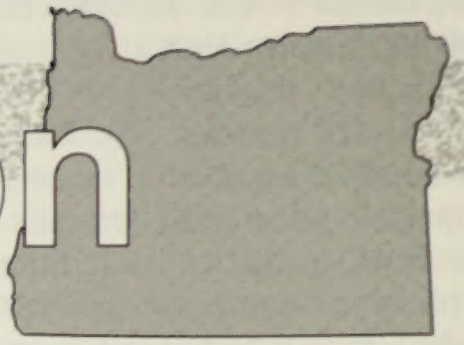
Oregon



Oregon has historically been one of the most progressive states regarding geographic information and GIS development and coordination. It has institutionalized a statewide approach to a larger extent than most states. The State Map Advisory Council (SMAC) has realized increasing strength through a series of Executive Orders. The most recent order in 1989 established the State Service Center for GIS, administratively located in the Oregon Department of Energy (ODOE), the first and largest GIS facility in state government. It also directed roles and responsibilities of SMAC, the GIS Service Center, the Executive Department's Information Services Division and other agencies in the attempt to meet statewide needs, and to provide the authority to ensure they are met. Accordingly, plans have been adopted in this regard. Oregon is also active in the Northwest Land Information Systems Network, a consortium of state and federal agencies, with activities including development of a spatial data index for the region. Oregon has numerous agencies with some GIS activities. These agencies include the GIS Service Center, and the Water Resources Department which has had in-house facilities since 1986. At least six agencies have contracted or plan to contract with the GIS Service Center for GIS services, and automated mapping activities are also underway in the departments of Forestry, Revenue, and Transportation.

1 Origins of State Initiatives

Oregon's state government began working with automated mapping in the 1970s, beginning in the Department of Forestry. In 1972 the department tested a rudimentary system for mapping and managing data for state forest lands, but it was discarded due to the difficulty in updating and maintaining it. In the late 1970s, the Department of Revenue began using a computerized drafting system to support mapping of land ownership plats. The Department of Forestry again studied several different systems and conducted a test mapping project in the late 1970s.

Oregon's coordination activities were among the earliest in the country, beginning in 1917 with the founding of a group which evolved into the State Map Advisory Committee (SMAC), which was established by Executive Order. During the following decades cooperative efforts concentrated on developing state base maps. Through succeeding Executive Orders, SMAC's scope broadened beyond most SMAC-like groups in other states; its responsibilities grew stronger, and individual members occupied higher level positions in their agencies. SMAC has been an active group since its inception, and it was this group which recommended that the state initiate one of its first GIS projects.

The Oregon Department of Energy (ODOE) began GIS activities in 1983 to analyze impacts from

coastal energy development, funded by the federal Coastal Energy Impact Program. The original idea was to hire a consultant to produce a report, but the SMAC recommended that the funds be used to purchase some in-house GIS capabilities to evaluate these impacts. For an initial investment of $52,000 for a small Data General computer, public domain software, data and staff, GIS activities began in ODOE in cooperation with the Department of Land Conservation and Development (DLCD). At the same time, the Department of Transportation made a major investment in a computerized design and drafting system to support engineering and mapping tasks.

Early ODOE projects dealt with coastal energy issues such as wetlands protection and estuary planning and zoning. These initial projects set the precedent of charging for services to help defray the cost of the system. In 1985 it was determined that existing hardware could not handle the project load. As a result, GIS needs were added to ODOE's agency-wide procurement of hardware and software. The system was then adjusted to run on the department's new minicomputer, and commercial software was implemented. In 1989, ODOE converted to a personal computer network, and the minicomputer was allocated to GIS.

The Water Resources Department began use of GIS in 1986 with the U.S. Geological Survey (USGS) for water basin planning. Since 1988, DLCD has been working with ODOE to develop an offshore database to be used with GIS. By 1989 there were five other agencies in state government with some GIS capabilities.

While SMAC was busy working with GIS related coordination in state agencies, GIS interests and needs in local government began to grow in the mid-1980s. As a result, an Executive Order establishing the Land Information Advisory Committee (OLIAC) was signed in 1986. The focus of OLIAC was on land records, particularly local government needs for cadastral mapping. This group was initiated because this need was not being met by SMAC. With a new governor in 1987, a broader and stronger Executive Order was issued for SMAC, which also changed its name to reflect its status as a council. Recognizing that both groups were addressing geographic information, this order merged SMAC with OLIAC for the purposes of strategic planning, resolving policy and technical issues, providing technical assistance and coordination, and fostering inter-agency and inter-governmental cooperation. SMAC adopted various goals, strategies, policy statements and plans of action in 1988 and early 1989.

At the same time that these activities were underway in state government, the Northwest Land Information Systems Network (NWLISN) was established through the agreement of agencies in Oregon and Washington. It originally included and continues to include federal agencies such as the USGS, the Bureau of Land Management, the Bureau of Indian Affairs, the Bonneville Power Administration, the Soil Conservation Service, the Forest Service, Fish and Wildlife, and the U.S. Army Corps of Engineers, as well as the states of Oregon, Washington, Idaho and Montana. NWLISN was created to provide natural resources agencies with an organized way of sharing data.

During the mid-1980s, since the Oregon Department of Energy (ODOE) was the first state agency to use GIS and had the largest GIS facilities throughout the decade, it served as an informal lead agency for GIS in Oregon. As other agencies began investigating and developing GIS, they frequently contacted the department for help and guidance. ODOE had difficulty conducting its required work and at the same time informally helping new users. In 1989, the Executive Department's Information Systems Division became involved, and through its efforts and those of SMAC and ODOE, it was agreed that a statewide GIS Service Center should be established. The center would be located in ODOE, and its GIS facilities became a statewide GIS Service Center. The center then became a separate administrative entity and service bureau, though it is physically located in ODOE. The purpose of the GIS Service Center is to coordinate and advance the use of GIS technology in Oregon. It is also charged with developing a digital database, managing digital data, and providing products and assistance. Various projects increased within state and federal agencies.

The state's most recent Executive Order related to geographic information coordination was signed on October 10, 1989. It mandated coordination and required agencies to work with SMAC and the GIS Service Center, which was also formally established by this order. It also directed that a statewide geographic information database be developed and a plan be completed to do so, including agency responsibilities for individual data layers. It required that GIS be compatible with statewide information processing and communications activities.

2 Coordination Efforts, Groups and Activities

Oregon has institutionalized geographic information coordination among state agencies to more of an extent than most states. Originally established in 1917, the State Map Advisory Council

(SMAC) has experienced increasing strength through a series of Executive Orders. Oregon's October 10, 1989 Executive Order is one of the strongest in the country specifically regarding geographic information; and accordingly, SMAC has more authority specific to geographic information than almost any similar group in the country. The order also created the State Service Center for GIS, administratively located in the Oregon Department of Energy, to help coordinate and advance the use of GIS technology within the state (see **Origins of State Initiatives** and **GIS in State Government**).

The 1989 Executive Order provided that SMAC include up to 12 members appointed by the governor from state agencies, and up to six non-voting members from federal and local agencies. The 12 appointed voting members of SMAC are director-level representatives of state agencies, including the following departments: Energy, Geology and Mineral Industries, Land Conservation and Development, Water Resources, Fish and Wildlife, Environmental Quality, Division of State Lands, Forestry, Transportation, and the Executive Department's Information Systems Division. In 1990 representatives of the Department of Human Resources (the state's social services agency) and the Department of Revenue were added to SMAC's membership. The Deputy Director of the Oregon Department of Energy, was elected in 1987 as SMAC's chair and continues to actively serve in this role. The GIS Service Center provides staff support for SMAC.

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Advisory, non-voting SMAC members include the federal Bonneville Power Administration, the Bureau of Indian Affairs, the Bureau of Land Management, the Fish and Wildlife Service, the Forest Service, the Geologic, National Mapping and Water Resources divisions of the U.S. Geological Survey (USGS), and the Soil Conservation Service. Other advisory members include representatives of the Lane Council of Governments, the Association of Oregon Counties, Portland's Metropolitan Service District, and Portland State University.

Since 1987, SMAC's directed purposes are strategic planning, resolving policy and technical issues and disputes, providing technical assistance and coordination, and fostering inter-agency and inter-governmental cooperation. The 1989 Executive Order was drafted and signed because the consensus was that the previous orders recommended but did not enforce coordination. It gave specific roles and duties to the agencies, SMAC and the GIS Service Center, including that state agencies' land records management, mapping, GIS and associated data development activities be coordinated with SMAC and the GIS Service Center. One of SMAC's major objectives is the standardization of data acquisitions. SMAC is also directed to provide a forum for the resolution of conflicts and to recommend legislative concepts and budget resources to implement plans and other projects. SMAC meets monthly and holds an annual meeting each spring. Each SMAC member agency takes its turn in sponsoring the annual meeting. The 1991 meeting was sponsored by the Department of Forestry. On May 21, 1991, as part of the annual meeting, USGS presented Oregon with a ceremonial copy of its "last quad," thus representing the completion of the 7.5 minute topographic map series for the state.

SMAC was "ordered and directed" by the executive order to develop a statewide geographic information database and to develop a plan to meet this need. Oregon has conducted some of the most thorough planning for geographic information and GIS development of any state, and has done so without help from external consultants. SMAC and GIS Service Center staff developed the first *Oregon State Map Advisory Council GIS Plan* in February 1990 as an implementation plan for the Order. It establishes "a blueprint and timetable for the development of an integrated GIS system for the State of Oregon." The plan addresses data and information, applications, the GIS network, and management structure. Plans are required every two years, and it is expected that the 1992 plan will address local level data needs, particularly land records. In addition, the GIS Service Center created its *Business Development Plan* in February 1991 (see below).

Three standing committees established by SMAC are increasingly active, and meet every other month. Among other issues, the GIS Committee is working on GIS job descriptions and career ladders, and is trying to establish a classified GIS series. The Executive Department also suggested revising the cartography series. The committee is helping to develop an information technology infrastructure with the Division of Information Services and is addressing the need for

supporting personnel development in the GIS field, including training.

While the GIS Committee concentrates on automated systems, the Oregon Mapping Committee is addressing manual mapping needs and issues. It is concentrating its 1991 efforts on standards for data documentation to complement GIS standards that were developed in 1990 by a special Standards and Procedures Workgroup (see below). It also conducts a prioritization process for to provide input to USGS for mapping. This committee is working with the GIS Committee to develop a revised cartography job series.

The Land Records Committee is addressing the need for a cadastral or parcel level database and geodetic referencing. It is developing a land records plan that can eventually be added to the 1992 SMAC plan, with a draft completed in late summer of 1991. Plans are to encourage the 1992 legislature to study uniform statewide addressing and to develop an appropriate scheme. Efforts are underway with Oregon's Enhanced 9-1-1 (E9-1-1) Committee to jointly participate in developing addresses, particularly in getting rural counties to uniformly address their roads. The E9-1-1 Committee has allowed funds from the telephone franchise tax to help finance addressing activities. Previously, a study of implementation and database issues concerning E9-1-1 was conducted by Portland State University for the Emergency Management Division and the Oregon Traffic Safety Commission (see **GIS in State Government**). Oregon is one of the very few states to include statewide addressing and E9-1-1 as part of its geographic information coordination scope and efforts. The committee is considering recommending that a county surveyor be established in each county with state surveyor authority to oversee activities. A similar approach exists for county attorneys, and it is expected that this mechanism could serve as a model.

SMAC also has had work groups considering specific issues. Since 1989, these groups have addressed policy promulgation, development of the 1990 plan, standards and procedures, and legislative/budget. Three of these work groups have produced written documents later approved by SMAC.

The Legislative/Budget Workgroup worked on funding for general coordination activities, although funds have been limited due to the state's growing financial difficulties. A decision package was prepared in the fall of 1990 and submitted by ODOE through the governor's budget request process. SMAC requested general appropriation funds of $450,000 for coordination efforts and data development, but the request was denied. At the request of the Legislature, presentations were made to the Joint Legislative Committee on Data Processing and the Ways and Means Committee during the spring of 1991. SMAC suggested to the committees that geographic data are statewide resources that need to managed from a statewide perspective. The committee expressed the concern that such a need and issue is important for all of the state's data resources, and that an appropriate state policy is needed for all information.

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It is envisioned that a work group addressing public access will be formed to help distinguish between public records and GIS databases. The group will evaluate charging for data, services, and products; and assessing the potential for restricting information of certain kinds. An evaluation of the Public Records Law and the role of the State Library is also expected. A bill was passed in 1991 providing that "intergovernmental groups" can jointly restrict access to GIS products. It allows for marketing and sales of information.

Relations With Other State Government Entities

In the 1989 Executive Order, SMAC was directed to work with the Executive Department's Information Systems Division (ISD) to establish policies to implement the statewide GIS plan, as well as to direct and oversee the GIS Service Center (see **GIS in State Government**). ISD is responsible for policy and planning for statewide information systems, as well as the operation of central data processing systems and services. It also has authority for approval of state agency plans and procurement of information systems.

Agencies are directed in the 1989 Executive Order to work with SMAC, ISD and the GIS Service Center in planning and developing projects involving the acquisition or use of existing data, hardware or software related to GIS. A partnership approach developed by the three entities is in accordance with management structure strategies agreed to in the 1990 SMAC plan, which provided that responsibilities and services be established.

SMAC was directed to ensure that all geographic information and related systems acquired are compatible with statewide information processing and communication needs. The Executive Order requires evaluation of proposed projects by SMAC and ISD, and within the agreement, agencies planning to use GIS or conduct work related to land records are required initially to discuss their plans with the GIS Service Center. The GIS Service Center developed a checklist to evaluate proposed GIS projects, and ISD is keeping a record of GIS procurements for SMAC. ISD is building a joint review process among agencies for various information technology requests, and SMAC serves in this role for GIS. Following the GIS Service Center's review, SMAC makes recommendations regarding any agency GIS plans and requests. ISD and the Budget Division make final decisions based on SMAC recommendations. Efforts are underway to jointly develop methods to monitor GIS and related data activities in state agencies in order to assure compatibility with one another and with the general information technology infrastructure in the state.

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Agencies have shown a willingness to participate in this statewide focus and process. In addition to the above requirements, state agencies were directed by the 1989 Order to appoint a GIS system manager or lead contact, and most have done so. Agencies were also directed to inform SMAC of their GIS data needs in addition to their planned projects in each January that falls in even years on a form prepared by ISD. The Executive Order and GIS Plan are one of the most definitive and forceful ones in the country, and provide that certain agencies would be designated by SMAC, upon the recommendation of the GIS Service Center, to be responsible for individual data layers, particularly at the 1:24,000 scale. Agencies are also directed to submit data to the GIS Service Center because it is the state's official digital data repository. They are to follow data exchange standards, have a designated GIS lead and internal data architecture and administration, develop draft data dictionaries, and use the GIS Service Center's GIS data index. Most agencies are expected to have these draft data dictionaries completed, including documentation on sources, caveats, processes used, quality and vintage. Agencies are generally complying with these directives and exercising "good data citizenship," but data development and implementation of data administration has been limited by a lack of resources.

Federal Relations

Strong GIS cooperation has traditionally existed between state and federal agencies in Oregon. A regional coordination group, the Northwest Land Information Systems Network (NWLISN) was established in August 1987 through an agreement of agencies in Oregon and Washington. Its purpose is to provide natural resource agencies with an organized way of sharing data. It originally included and continues to include federal agencies such as USGS, the Bureau of Land Management (BLM), the Bureau of Indian Affairs, the U.S. Forest Service (USFS), the Bonneville Power Administration, the Soil Conservation Service, Fish and Wildlife, and the U.S. Army Corps of Engineers. Oregon state agencies participate under the leadership of SMAC. The state of Washington, and to a lesser extent, Idaho, also participate in NWLISN. NWLISN is co-chaired by state officials of BLM and USGS. NWLISN's Management Steering Group adopted a charter with the following goals: communications, cooperative data production projects, inventories of existing digital data, encouraging adoption of data production and format standards, and evaluating data management strategies.

Earlier, federal relations with Oregon's state government were initiated by a Memorandum of Understanding (MOU) between the Oregon governor and the State Director of BLM and the Regional Forester of the Pacific Northwest Region of USFS in January, 1986. The MOU was signed to provide a process for the three entities to jointly identify, communicate and coordinate actions relating to the lands and resources administered by them, and to provide a mechanism for continuing involvement in the development and revision of land management and land use plans. It specifies that each entity will develop and carry out an active communication program to apprise each other of proposed planning, policy formulation, management efforts and other activities affecting the others. The state agreed to assist in securing agreements with state agencies, local governments, and other entities in the state in order to carry out the intent of the agreement. In addition, ODOE conducts work for federal agencies, such as digitizing and custom database design and development work for USFS's Columbia River Gorge National Scenic Area (see **GIS**

in State Government). Federal agencies are non-voting members of SMAC (see above).

A current NWLISN effort is the *Spatial Data Index* being developed by the GIS Service Center. It was initially funded with $20,000 from federal agencies and $10,000 from state agencies in Oregon and Washington. The index will serve as catalog of digital cartographic data, enabling subscribers to locate the existence of data and providing contact and system information to facilitate data exchange. As a cataloging service, it will not act as a broker of or clearinghouse for data. Efforts are underway to develop the index, which includes three interrelated components, including an Agency Database, with contact and systems information; Spatial Cross-Reference Database; and Thematic Holdings Database. It currently operates on a SUN workstation using ARC/INFO software, with queries and reporting provided by phone and in writing. Following implementation of these services, and providing that an adequate data maintenance plan is in place, extensions to the basic services are expected to include on-line direct links, and/or distributed indexing. The final system will be ported to Oregon and Washington, who will then maintain and provide access to their state specific data. In Oregon, the GIS Service Center will provide access at both its office and the state library.

NWLISN pilot projects include the Lower Umpqua Digital Exchange Project near Coos Bay which was conducted to identify issues relating to the sharing of digital data. It began in March 1988 and was completed September 19, 1990 with a final report issued at that time. Twelve state and federal agencies participated in the project through a MOU signed by these agencies and a NWLISN work group. An 11-quadrangle area in Oregon's central coastal area was chosen as the project site because several agencies were actively developing data in this area, and because some management problems were being experienced there. The goal of the project was to see if costs could be reduced while improving the effectiveness of problems being addressed. Existing and planned digital data were inventoried, and common data categories required for each agency were prioritized. Data layers from various agencies were combined, and in one plot, six agencies each contributed a category to make a graphic similar in format to a USGS 1:24,000 scale quadrangle. In another plot, Public Land Survey System data from five different agencies was plotted together "to show the wide variation in agency representation." Digital data was exchanged, and problems, restrictions, costs and usefulness were documented. One problem addressed was that even when similar software was used, agencies encountered difficulties due to different hardware systems. The project helped to reveal that there is little cooperative development of uniform attributes, and that work in general creates digital data and attributes to meet agency specific requirements. The project spawned the first digital data index in the area, and the results of the work completed contributed to the Oregon Spatial Digital Data Standards.

Agencies are directed in the 1989 Executive Order to work with SMAC, ISD and the GIS Service Center in planning and developing projects involving the acquisition or use of existing data, hardware or software related to GIS.

In addition to these NWLISN activities, the Bonneville Power Administration (BPA) contracted with the GIS Service Center to develop a database of the impacts of potential sites for new hydropower facilities. In this effort, Oregon has worked with BPA, and the states of Idaho, Montana and Washington since 1985 to create a multistate database for the region. The Pacific Northwest Stream Information System is being built with assistance from the USGS, the U.S. Environmental Protection Agency (EPA), the Bonneville Power Administration, and the Northwest Power Planning Council. Work will be conducted with USGS for scanning and remote sensing work.

Policies/Standards

Policies and procedures are being developed with the Information Services Division and SMAC to ensure that acquisition of data and technology is cost-effective, compatible with statewide needs, and does not duplicate the efforts of other agencies or the GIS Service Center. Data access policies are being developed to include distinguishing between public records and GIS databases. Other policies address charging for data, services, and products; the potential for restricting information of certain kinds; the role of the State Library, and an evaluation of public records laws. SMAC was also directed to establish standards and procedures for acquisition and use of land information and related systems.

Digital Spatial Standards and Procedures were developed by SMAC's Standards and Procedures Work Group, and adopted by SMAC on March 22, 1990, as directed by the 1989 Executive Order. This document is organized to includes general standards and other more specific standards, including:

• Digital Data Capture Standards include standards regarding position, elevation, attribute, edgematching and content accuracy, as well as source graphic lineage reports.

• Digital Base Category Data Standards specify that the primary scale for the state will be 1:24,000, and that larger scale data is the responsibility of individual agencies, while the GIS Service Center will serve as the repository of all smaller scale data. The document establishes minimum base data categories and sources, including the Public Land Survey System, transportation, surface hydrography, boundaries, generalized ownership for public lands, terrain, and geographic names.

• Digital Output Format Standards include output format standards, data quality report standards, and output graphics standards. Data element dictionary standards are also included.

GIS in State Government

Oregon has many state agencies working with GIS. The Oregon Department of Energy initiated the state's first implementation of such technology and is currently serving as the lead state agency for GIS with the State GIS Service Center. The Executive Department's **Information Systems Division** (ISD) is responsible for policy and planning for statewide information systems, as well as for operation of central data processing systems and services. It has approval authority over state agency plans and procurement of information systems. While ISD does not have operational GIS activities, its staff has been actively involved in the State Map Advisory Council (SMAC) and GIS activities since the late 1980s. It has been developing a partnership with SMAC and the GIS Service Center to institutionalize review of GIS activities in agencies to help meet statewide needs (see **Coordination Efforts, Groups and Activities**).

The **Oregon Department of Energy** (ODOE) served as the informal lead GIS agency between the mid-1980s and 1989 as it had the largest GIS facilities in state government. Following work for ODOE's Coastal Energy Impact Program with the Department of Land Conservation and Development beginning in 1983, a precedent was established of charging for services to help defray the cost of the system. The **State Service Center for GIS** was officially established by Executive Order in October 1989 as the central entity to provide statewide services and coordination, with policy and planning direction from SMAC. The primary purpose of the GIS Service Center is to coordinate and advance the use of GIS technology within the state. The GIS Service Center was authorized to be a cash-funded service bureau, and is administratively and financially separate from ODOE. The purpose of the GIS Service Center is to develop, administer, and maintain Oregon's digital database, while also providing products, services and assistance. Work is conducted in three areas:

• Providing services to client agencies which may or may not have their own GIS, and frequently serving as an interim measure for state agencies before acquiring in-house GIS capabilities. The GIS Service Center provides technical support, and information and referral on a cost reimbursement basis to state, federal and local agencies. Specifically, the GIS Service Center provides digitizing, data transfer and formatting, database design and construction, pilot projects, menu programming, analysis, training, and consulting. Support for small users and personal computers is a high priority, since this helps to advance the use of GIS technology. Various state agencies have contracted with the GIS Service Center, including the Department of Environmental Quality, the Department of Fish and Wildlife, the Department of Agriculture, the Department of Land Conservation and Development, the Executive Department's Division of State Lands and Emergency Management Division, and the Legislative Administration Committee (see below).

• Building the digital database for the state, as the GIS Service Center was directed by the Executive Order to develop a statewide digital database (see below). The GIS Service Center's GIS "starter kit" provided to agencies includes available base data appropriate for agency needs.

• Data administration, including the coordination of data distribution and assisting in data transfers between systems, such as facilitating transfer in a compatible manner with federal systems.

The GIS Service Center has eight staff members that includes the GIS Manager, a System Analyst, a GIS Analyst, an Office Coordinator, and four GIS Technicians. Efforts are underway for classified personnel job descriptions to be established. Plans exist to hire a database administrator, but currently this proposal is unfunded. The Deputy Director of ODOE is the chair of SMAC.

The GIS Service Center's FY 1991 budget was approximately $400,000, and the FY 1992 budget is $600,000. The GIS Service Center operates as a fee-for-service bureau. It is estimated that approximately $1 million will be contracted to the center in the 1991-93 biennium. The GIS Service Center estimates the financial level of GIS activities in Oregon to be about $5.25 million, including

in-house work, GIS Service Center work, and contracts to private consultants. Another estimated $2 million is spent in related work. Of this total work, $3 million is work in natural resource related agencies, $3.3 million in infrastructure related agencies, $500,000 in human resource agencies, and another $200,000 in other agencies. Of this total, $4.7 million is estimated to be performed in-house, $1.3 million contracted to the private sector, and $1 million contracted to the GIS Service Center.

ODOE's GIS technology has gone through four stages of evolution. Beginning in 1983, GIS operated on a small Data General computer using MOSS public domain software. In 1985 this system was replaced as part of ODOE's agency-wide procurement of hardware and software. GIS operations were moved to the department's new Prime 2655 minicomputer, and ARC/INFO software was implemented. In 1989, ODOE converted to a personal computer network for data processing, and the minicomputer was dedicated to GIS. Efforts to switch to a network of six SUN workstations is complete. In addition, image processing software and scanning technology have been acquired.

The GIS Service Center has a variety of activities and plans underway, many of which are outlined in the *GIS State Service Center Business Development Plan* prepared in February, 1991. The 1991 legislature requested the development of this plan and upon its review decided to fund a one-time appropriation of $300,000 to the GIS Service Center for GIS hardware and software. Primary efforts of SMAC and the GIS Service Center concern data sharing and development. The 1990 SMAC plan stated that "the first step is to set up mechanisms and standards to assure that geographic data can be shared among systems." Accordingly, the following series of objectives were outlined:

1. Establish a data administration function
2. Capture data
3. Monitor and acquire data
4. Develop data standards
5. Develop data element dictionaries
6. Support a data index
7. Promote data coordination
8. Create a statewide digital base map

Efforts regarding data development are proceeding with available resources in each of the following areas, with details discussed in the center's 1991 plan:

- **Statewide Digital Base Map**

Data development efforts to date have concentrated on completing the 1:100,000 scale base, including the Public Land Survey grid, transportation, surface hydrology, boundaries, and geographic names. The GIS Service Center will manage and update this base map every two years. In addition, the center is the repository for the Census Bureau TIGER data.

Efforts are underway to have generalized ownership and terrain data at the 1:100,000 scale completed by 1992. Plans also exist to collect all existing base data from digital mapping efforts in Oregon, and then have the center fill in the gaps through scanning, cooperative agreements or purchase, and later combine and distribute these data as a base map set for all users; however, funds were not approved for an accelerated effort. Scanning technology has been acquired, and will be used initially to create a digital version of Oregon's National Wetland Inventory data and to digitize the 1:100,000 ownership layer.

A major missing element identified in most projects is a land ownership map.

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Following directives in the 1990 plan, data responsibilities for layers at the 1:24,000 scale have been defined for various agencies. The center may also maintain some commonly used layers at this scale. Agencies with lead roles are directed to be responsible for data accuracy, currency and accessibility, and to provide updates of the data to the state's digital map base.

- **Digital Parcel Map**

A major missing element identified in most projects is a land ownership map. Currently, the only sources of digital parcel information are the Department of Revenue (DOR) or individual counties. DOR's digital parcel level maps are of very high quality, but the process is slow and may take another 15 to 20 years to complete. State agencies and counties have expressed the need to attach parcel-related data to parcel level maps. A method of accessing data held by counties is a high priority since the counties update and maintain parcel data and this resource would be of great assistance for more detailed GIS work.

- **Satellite Imagery Base Map**

The GIS Service Center has limited satellite imagery, but receives many requests for it. A statewide coverage would facilitate analysis of land use, water right violations, water use, timber severance taxation, urban growth patterns, pollution, and have other uses. This map could be combined with digital databases. Efforts are underway to develop a land cover and land use map at the 1:100,000 scale with the USGS and other agencies. Image processing software has been purchased to help meet this need.

- **Elevation Model**

Another unfulfilled need is for elevation and contour information. This data can be used to determine slope, aspect and elevation of any land surface. It is often a component in analysis of building suitability, watershed capacity, acceptable land use, slide and erosion hazards, flood potential, habitat use, and other aspects. Discussions are underway to obtain such data.

Following directives in the 1990 plan, data responsibilities for layers at the 1:24,000 scale have been defined for various agencies.

One of the main goals of the Center is indexing digital data holdings and providing them to users. The Center has a locator system to identify available digital data for an area. The Center has conceptually designed a database/map structure that could allow for finding data by area, source and topic. The Center is currently in the design phase of implementing its digital map library project, which will include an on-line system primarily for in-house use, but funding for implementation is tentative. The Center is the contracting office for the Northwest Land Information System Network's (NWLISN) *Spatial Data Index* being developed by Portland State University (see **Coordination Efforts, Groups and Activities**, Federal Relations). A textual, on-line Public Access Catalog is available in the State Library, and includes some information about digital data of state and federal agencies. SMAC published the *Oregon GIS User Reference Guide* in January 1988, a brochure with information about contacts, hardware, software, and coverage and data themes of state, federal, local and other GIS users in the state.

In addition to these data and information plans, SMAC plans to develop a distributed processing GIS network with personal computers and workstations that are linked with information technology services provided by ISD. The network is expected to be compatible with federal systems and data archives. The Center is conducting various educational, service, and marketing efforts. It plans to begin publishing Oregon's GIS newsletter, which began in 1985. The Center held a conference in May, 1991 for local governments on the use of Census Bureau TIGER and GIS for redistricting for local needs. This conference prompted local governments to consider using the GIS Service Center to conduct work to meet these local needs.

Various GIS projects are currently underway at the GIS Service Center, many in cooperation with and under contract with state and federal agencies. In a contract with the U.S. Forest Service (USFS), the Center has done custom database design, digitizing and development work for the Columbia River Gorge National Scenic Area. The Columbia River Gorge National Scenic Area legislation, adopted on November 17, 1986, required USFS to provide technical assistance to the commission that was established by the legislation. It was determined that planning and analysis should be based on a single comprehensive database using GIS. The Center conducted this work with the state of Washington as the area is on the border between Oregon and Washington and the information is loaded in the Washington Department of Natural Resource's GIS.

The **Water Resources Department** has had in-house GIS activities since 1986 to meet agency needs. It uses ARC/INFO on micro VAX computers, with four staff members, and an annual budget of approximately $150,000.

Initial GIS efforts in the Water Resources Department were conducted with the USGS for water basin planning, and are also being used to support groundwater management and water right tracking. The tabular Water Rights Information System (WRIS) has over 100,000 records. The in-house GIS facility is digitizing the parcels that water rights are issued to and linking them back to the WRIS data. Concurrently, basin-wide planning data is entered for the basin planning process. The hope is to eventually be able to determine water availability and water use, and to track who has rights to that water. Under discussion with the Center is the use of satellite data to determine place of use, cross-referencing this information with the water rights map, and then determining any water right violations.

The **Department of Environmental Quality** (DEQ) is currently using GIS with one pcARC/INFO site and contract work with the GIS Service Center. DEQ's annual budget is approximately $100,000, with one main staff person. Some U.S. EPA funds are used to support GIS activities.

DEQ's Water Quality Division and Information Services staff are working with the GIS Service Center to make more active use of GIS in surface and groundwater quality protection efforts. The department has been working with U.S. EPA to develop a statewide clean water strategy, including demonstrating the usefulness of GIS. GIS efforts have been underway in various projects including non-point source pollution, and

identifying leaking underground storage tanks along with the Environmental Cleanup Division. DEQ is using GIS to support the Coastal Oil Spill Contingency Plan in coordination with the Department of Fish and Wildlife and DLCD's Ocean Information System. The Hazardous Spill Response project has been integrated to the ocean system to provide for protection of valuable resources from hazardous materials. All of this work is being done by the GIS Service Center.

The **Department of Fish and Wildlife** (DFW) is beginning to use GIS. Currently six workers spend approximately 40% of their time on GIS, and the department contracts with the GIS Service Center and the U.S. Fish and Wildlife Service (FWS) for individual projects.

Initial GIS efforts in the Water Resources Department were conducted with the USGS for water basin planning, and are also being used to support groundwater management and water right tracking.

The department's GIS work is for individual projects. One of the department's major GIS efforts is the use of gap analysis to conduct a species biodiversity study. This effort has a great deal of support as the department has committed to the long-term development of a full species information system for the state. This project involves overlaying known occurrences of plant and animal species, vegetation and other layers to identify habitat associations in upland areas useful for a variety of purposes, including various environmental assessments. This work is being conducted under contract with FWS, based on previous projects completed in Idaho (see Idaho profile).

In addition, several projects have been underway concerning elk distribution and spotted owl habitat. For example, the department is using pcARC/INFO software and satellite imagery for elk research at the Starkey Pacific Northwest Research Area southwest of LaGrande. The first priority is to study the relationship of deer, elk and livestock to understand how they use the plant community, and to learn what the competition is for its use. A preliminary conclusion is that there is less competition between the species than originally thought. The department is also coordinating a regional spotted owl study with Oregon, Utah and California. This work will be done through the GIS Service Center.

The Marine Habitat Program is using MapGrafix software on a Macintosh computer as part of efforts to develop a marine resources database and fisheries catch database on the continental shelf. This project is being conducted in coordination with the GIS Service Center, and data is being transferred between systems.

The **Department of Land Conservation and Development** (DLCD) was created to monitor land use planning in the state. Oregon was the first state in the country to have statewide land use planning. The agency does not have any staff or equipment allocated for GIS, but has worked with ODOE since 1983 when both agencies supported the implementation of GIS facilities in ODOE for the Coastal Energy Impact Program. Most of DLCD's current GIS efforts are specifically for coastal management and planning purposes, though some consideration is being given to using GIS for other purposes. Consideration is also being given to develop ties to local government GIS projects for planning and review functions.

The Ocean Management System is DLCD's largest GIS activity, which is a multi-agency effort being developed for use in ocean resource management planning and decision making. The system is being developed with approximately $160,000 in state funds and $30,000 in federal funds. It is being prepared under contract with the GIS Service Center, which has conducted a variety of work for the agency. The initial and existing objective of the system is to provide a foundation to determine the affect of non-renewable resource activities such as oil and gas exploration, or placer sand mining. It is also being used for oil spill contingency planning, and habitat and species assemblage investigations. Data from a variety of local, state and federal agencies is being gathered and digitized for use with the system. The database is part of a larger effort to coordinate state agencies' policies and programs regarding the Territorial Sea, which extends a distance of three nautical miles from the coastline, and the Exclusive Economic Zone (EEZ) which extends 200 nautical miles into the ocean. Some of the data includes the EEZ.

In a related effort, Oregon is a "beta test site" for the West Coast of North America Colonial Seabird Information System, which was developed by the Strategic Environmental Assessments Division in the National Ocean Service of the National Oceanic and Atmospheric Administration. The division created this desktop information system, which serves as a prototype windowing system for accessing available digital data. The project will help determine the usefulness of desktop information systems to state and local agencies in their effort to support resource policy discussions.

Beginning in 1972, the **Department of Forestry** was the state's first agency to investigate the use of automated cartography. Its Cartographic Services Section is using an Intergraph system with three stations to meet mapping needs, with six staff members and an annual budget of approximately $400,000. In addition, the Protection Division is considering use of GIS for slash burn and smoke management applications, as well as for conducting industrial forest land inventories.

The **Department of Revenue** has an automated drafting system using Intergraph software for parcel mapping. The system was initiated in the late 1970s, and is producing plat maps for counties based on researched surveys. The graphic data includes accurate parcel boundaries, but it is estimated that completion of this mapping effort for the entire state could take up to 20 years. Current annual expenditures on this entire process is over $1 million.

The Executive Department's **Division of State Lands** is using GIS with the GIS Service Center, and has pcARC/INFO in-house with one staff member in the division spending half-time on GIS.

Oregon is a "beta test site" for the West Coast of North America Colonial Seabird Information System.

One of the division's missions is to develop an accurate State Lands Inventory of land ownership, leases and resources. Use of GIS has been initiated in a pilot project with the GIS Service Center for Clatsop County using USGS's DLG files, the Public Land Survey System, and the division's land inventory. Efforts are underway to conduct navigable river mapping and specific waterway management plans. The division is responsible for the state's wetlands inventory paper maps, and efforts are underway to use GIS for this mapping and analysis, while the GIS Service Center is responsible for the digital version of the data. The division's first project was recently completed on the lower Willamette River. This effort included development of a system to track surface and subsurface ownership leases, resource location and replenishing rates. Faster response to public inquiries is desired from automating lease files and maps under the Abandoned Mine Lands Program. Analysis of land swaps and sales is also possible with higher degrees of confidence.

The Executive Department's **Emergency Management Division** contracted with the GIS Service Center to provide expertise and project oversight for a joint effort with the Federal Emergency Management Agency (FEMA). This project constructed a map base for FEMA's Integrated Emergency Management Information Systems (IEMIS) project.

In 1988, this division and the Oregon Traffic Safety Commission contracted with the Center for Urban Studies at Portland State University to prepare a report entitled *Implementation and Database Issues involved in Enhanced 9-1-1 Emergency Services and Rural Addressing Systems.* This project was conducted to define and address some of the key issues and needs in implementing E9-1-1 systems in the state. E9-1-1 differs from 9-1-1 in that addresses of callers are provided to dispatchers, as well as emergency service zones in order to ensure that the appropriate emergency vehicles are sent to the address. The major concern addressed in the report is the development of a database in which the street address of a caller to an emergency dispatch system is linked to the appropriate emergency service zone. The effort concluded that development of a master street address guide is necessary for computer-aided dispatch, and Census Bureau TIGER line files could be used to develop the necessary data to support E9-1-1.

The **Department of Human Resources** is the state's social services agency, and is the largest agency in state government. It is interested in testing GIS to assist in monitoring teen pregnancy and plans to conduct some GIS work with the GIS Service Center.

The **Department of Agriculture** plans to conduct GIS work to help analyze field burning, pest control, threatened plant species, suitable agricultural lands and other program needs.

The **Department of State Parks** is using an automated drafting system to map state park areas, both as a planning tool and in order to support maintenance and inventory needs.

The **Department of Transportation** (DOT) has been using computer-aided mapping since 1984 with an Intergraph system, and spends approximately $650,000 per year on this effort. It is used to develop statewide, county and city mapping bases. GIS analyses are being conducted by linking the state's road inventory database on DOT's IBM mainframe and transportation graphics files on the Intergraph system. Road inventory data is being converted for transfer to the IBM's DB2 relational database. It was decided that the mainframe and graphics systems would be kept separate, yet linked together by highway and milepost numbers to generate graphics when needed. Analysis is accomplished on the mainframe and summarized for display on the graphics system. The DOT also developed a procedure for the automated placement of text from the Geographic Names Information System (GNIS) into an Inter-

graph computer graphics file.

The **Legislative Administration Committee** contracted with the GIS Service Center to support its Legislative Reapportionment project. The center is loaded the Census Bureau TIGER files as a base map and worked with ESRI to build a responsive system for the reapportionment process. Over 1,000 maps were generated over a three month period. The GIS Service Center is now supporting the Secretary of State's office for the final reapportionment tasks. Additional work may be conducted for local reapportionment needs.

Academic Activities

Portland State University's Center for Urban Studies has GIS facilities and provides GIS consulting for government agencies at all levels. The center's director has been an active participant in the state's efforts, particularly regarding parcel level data. He was a founding member of the Land Information Advisory Committee (OLIAC) established by Executive Order in 1986 to focus on land records, and particularly on local government needs. One of the center's current efforts is its contract through the state DOE with the Northwest Land Information Systems Network (NWLISN) to prepare a *Spatial Data Index* to serve as a catalog of digital cartographic data (see **Coordination Efforts, Groups and Activities**, Federal Relations). Previously, the center worked under contract with the Executive Department's Emergency Management Division and the Oregon Traffic Safety Commission to prepare a report entitled *Implementation and Database Issues involved in Enhanced 9-1-1 Emergency Services and Rural Addressing Systems* (see above, Emergency Management Division).

The center is also involved in national level transportation-related GIS efforts. The center conducted work in 1990 for Tri-Met, the transit provider in the Portland metropolitan area, and for the U.S. Department of Transportation via TransNet, a transportation research center consisting of a consortium of Pacific Northwest universities. This work resulted in the report entitled *GIS Applications for Tri-Met: Needs Analysis and Preliminary Implementation Plan*, which reviews how Tri-Met can integrate data with a common geographic base for various transit applications, including facilities management and engineering, service planning, operations and control, and customer service. GIS applications are used as tools to integrate data. Implementation issues examined include systems integration and data transferability; visualization and mapping requirements; real-time dispatch, communication, and control; Census Bureau TIGER data enhancements to support Tri-Met applications; initiating GIS applications; and organizational alternatives.

Geography Departments at **Oregon State University** (OSU) and the **University of Oregon** are both using GIS for various efforts. OSU is working with remote sensing to help conduct analyses of lands available for development, including efforts to distinguish the classification of these lands. The University of Oregon is developing the Oregon Atlas using automated cartography.

4 Documents List

Directive

Executive Order 89-16, Oregon **State Map Advisory Council**, October 10, 1989.

This Executive Order is the fourth one relating to the roles and responsibilities of the State Map Advisory Committee, established by Executive Order in 1917. A 1987 order established SMAC's functions, which include strategic planning, resolution of policy and technical issues, technical assistance and coordination, and fostering of inter-agency and inter-governmental cooperation. The 1989 order specified the membership of SMAC, including an Executive Board of up to 12 voting members from state agencies and up to six non-voting members from federal and local agencies. The main points of the 1989 Executive Order included the following provisions. The SMAC is directed to develop a statewide geographic information database, designate agencies to be responsible for and manage particular data sets, develop a plan, work with the Information Systems Division (ISD), ensure that acquisition of geographic information and related systems is compatible with statewide information processing and communication needs, recommend legislative concepts and budget resources, establish standards and procedures, and provide policy and planning direction for the state and to the GIS Service Center regarding geographic information. The GIS Service Center is also authorized by the order to function at the Oregon Department of Energy in order to provide a database, develop and administer digital data, and provide products and assistance. Coordination among agencies, SMAC, and ISD is directed, including review and approval of GIS plans and procurements, specified data distribution and transfer mechanisms, and specified agency responsibilities.

Memorandum of Understanding

Memorandum of Understanding Between the Governor of Oregon and the State Director of Bureau of Land Management, U.S. Department of the Interior, and the Regional Forester, Pacific

Northwest Region, Forest Service, U.S. Department of Agriculture, January 8, 1986.

This Memorandum of Understanding was signed by the governor of Oregon, the State Director of the Bureau of Land Management, and the Regional Forester of the Pacific Northwest Region of the U.S. Forest Service in the attempt to provide a process for the three entities to jointly identify, communicate and coordinate actions relating to the lands and resources administered by them, and to provide a mechanism for continuing involvement in the development and revision of land management and land use plans. It specifies that each entity will develop and carry out an active communication program to apprise the others of proposed planning, policy formulation, management efforts and other activities affecting the others. The state offered to assist in securing agreements with state agencies, local governments, and other entities in the state to carry out the intent of the agreement.

Participating Agreement between Oregon Department of Energy and USDA Forest Service, Columbia River Gorge National Scenic Area, September 16, 1988.

This agreement was signed by the Oregon Department of Energy (ODOE) and the USDA Forest Service's Columbia River Gorge National Scenic Area in order for GIS services to be provided by the GIS Service Center to the Forest Service. The Columbia River Gorge National Scenic Area Legislation, adopted on November 17, 1986, requires the Forest Service to provide technical assistance to the commission established by the legislation. It was determined that planning and analysis should be based on a single comprehensive database using GIS. The Forest Service contracted with the GIS Service Center for natural resource custom database design and development.

Plans

GIS Service Center Business Development Plan, Oregon State Service Center for GIS, February, 1991.

This plan was developed by and for Oregon's State Service Center for GIS, which was officially established in October, 1989 by Executive Order, following over five years of GIS experience in the Department of Energy (ODOE). The center is administratively located in ODOE, but is funded solely by revenue generated from fees for service. The plan describes the products and services of the center, including a description of its strengths and weaknesses. Objectives of the center include advancing and coordinating the use of GIS related technology in the state; reducing the costs of data analysis, storage and display; and improving the human and natural environment since this objective is "a source of pride" for the center's staff. Existing and planned statewide agency projects are described, as well as a review of product characteristics, and operations of the center. The plan includes a description of the center's management structure and staff, financial structure, pricing considerations, and billing and contract procedures. It provides a thorough review of the history and market for the center, discussion of competition, and a marketing and sales plan. Financial projections and growth plans are also included.

The Oregon State Map Advisory Council: GIS Plan, Oregon GIS Committee, GIS Plan Working Group, and the GIS Standards and Procedures Working Group of the SMAC and Scott E. Smith, Interim GIS Data Administrator, February 15, 1990.

This plan was required by a 1989 Executive Order to be conducted by the State Map Advisory Committee (SMAC). It establishes "a blueprint and timetable for the development of an integrated GIS system for the State of Oregon." The plan has four major sections including Data and Information, Applications, GIS Network, and Management Structure, as well as a glossary, goal statement, and Appendices including a copy of the 1989 Executive Order, a draft outline of GIS data standards, and a list of SMAC members. Strategies for data and information include administration; monitoring, capturing and acquiring data; standards; data dictionaries and index; promoting data coordination and creating a statewide digital base map. It was determined that the State Service Center for GIS would manage and update the digital base map every two years, develop a GIS "starter kit" of digital base map data, and provide this kit, consulting, technical help and training to clients. Planned data development efforts include concentrating on the 1:100,000 scale for Public Land Survey grid, transportation, surface hydrology, boundaries, geographic names (to be completed by July, 1991), and generalized ownership and terrain (to be completed by July, 1992). The plan stipulates that agencies would be responsible for certain layers at the 1:24,000 scale, and the center may also maintain some commonly used layers at this scale. Agencies were also directed to select a lead agency contact for GIS, provide information about GIS plans, and develop draft data dictionaries. The council describes plans to develop a data network, with the center providing services which include large database creation, bulk plotting, image processing, and a base data library. Plans to develop a public access policy, communications link and a GIS job series were also described.

Standards

Digital Spatial Standards and Procedures, Oregon State Map Advisory Council, Standards and Procedures Work Group, Glenn Ireland, Work Group Chairman, March 22, 1990.

The 1989 Executive Order directed the State Map Advisory Committee to "establish standards and procedures for the acquisition and use of land information and related systems" as a complement to the GIS Plan for the state. The document is organized to include general standards and other specific standards. Digital Data Capture Standards include standards regarding position, elevation, attribute, edgematching and content accuracy, as well as source graphic lineage reports. Digital Base Category Data Standards prescribe that the primary scale for the state will be 1:24,000, and that larger scale data is the responsibility of individual agencies, while the center will be the repository for all smaller scale data. The document establishes minimum base data categories and sources, including the Public Land Survey System, transportation, surface hydrography, boundaries, generalized ownership for public lands, terrain, and geographic names. Digital output format standards include data quality reports, and spatial output graphics. Data element dictionary standards are also included.

Publications/Reports

NWLISN (Northwest Land Information Systems Network) Spatial Data Index Project: Quarterly Progress Report, Vrana, Ric, et al., Portland State University Cartography Center, June 30, 1991.

This report describes the Northwest Land Information Systems Network's (NWLISN) Spatial Data Index being prepared by Portland State University through its contract with the GIS Service Center. NWLISN is a consortium of federal and state agencies working in Oregon and Washington. The index will serve as catalog of digital cartographic data, enabling subscribers to locate the existence of data and providing contact and system information to facilitate data exchange. As a cataloging service, it will not act as a broker or clearinghouse for marketing data. The index includes three inter-related components, including an Agency Database, with contact and systems information; a Spatial Cross-Reference Database; and a Thematic Holdings Database. It currently operates on a SUN workstation using ARC/INFO software, with queries and reporting provided by phone and in writing. Following implementation of these services and providing that an adequate data maintenance plan is in place, extensions to the basic services may include on-line direct links, and/or distributed indexing. The report includes the Participating Agency Reporting Form, and contains lists of thematic topology and thematic attribute keywords used in the index.

GIS Applications for Tri-Met: Needs Analysis and Preliminary Implementation Plan, Dueker, Kenneth, et al., Portland State University, Center for Urban Studies, Portland, Oregon, October, 1990.

This report describes how Tri-Met, the transit provider in the Portland, Oregon metropolitan area, can integrate data with a common geographic base to increase efficiency and effectiveness. It was written for Tri-Met and the U.S. Department of Transportation via TransNet, a transportation research center consisting of a consortium of Pacific Northwest universities, with the lead university being the University of Washington. The report examines the suitability and flexibility of a common geographic database for various transit applications, including facilities management and engineering, service planning, operations and control, and customer service. GIS is also used as a tool to integrate data. Implementation issues examined include systems integration and data transferability; visualization and mapping requirements; real-time dispatch, communication, and control; Census Bureau TIGER data enhancements to support Tri-Met applications; initiating GIS applications; and organizational alternatives. An implementation plan is included in the report.

Final Report to the Northwest Land Information Systems Network of the Lower Umpqua Digital Exchange Project, Lower Umpqua Digital Exchange Project Workgroup, September 19, 1990.

This document is the final report of the Lower Umpqua Digital Exchange Project, which began in March, 1988 through a memorandum of understanding among 12 state and federal agencies in the Pacific Northwest. It was formed under the guidance of the Northwest Land Information Systems Network (NWLISN), and the workgroup included the 12 agencies represented in NWLISN. The project was conducted to identify issues relating to the sharing of digital data. An 11-quadrangle area in Oregon's central coastal area was chosen as the project site because several agencies were actively developing data in this area, and because some resource management problems were being experienced there. The goal of the project was to see if costs could be reduced while improving the effectiveness by which problems could be addressed. Existing and planned digital data was inventoried, and common data categories required for each agency were prioritized. Data layers from various agencies were combined into the same graphic. In one plot, six agencies each contributed a category to make a graphic similar in format to a USGS 1:24,000 scale

quadrangle. In another plot, Public Land Survey System data from five different agencies was plotted together "to show the wide variation in agency representation."Digital data was exchanged, and problems, restrictions, costs and usefulness were documented. Some problems included that even if similar software was used, agencies encountered difficulties due to different hardware systems. The project helped reveal that there is little cooperative development of uniform attributes, and generally creates digital data and attributes to meet agency requirements. The project spawned the first digital data index in the area, and the results of the project contributed to the Oregon Spatial Digital Data Standards.

Implementation and Database Issues involved in Enhanced 9-1-1 Emergency Services and Rural Addressing Systems, Dueker, Kenneth, et al., Center for Urban Studies, Portland State University, Portland, Oregon, February, 1989.

This report was prepared for and funded by Oregon's Emergency Management Division and the Oregon Traffic Safety Commission. It was prepared to define and address some of the key issues and needs in implementing Enhanced 9-1-1 (E9-1-1) systems in the state. E9-1-1 differs from 9-1-1 in that addresses of callers are provided to dispatchers, as well as emergency service zones to ensure that the appropriate emergency vehicles are sent to the address. The report has three sections, including one which provides strategic options for implementing E9-1-1, which reveals that phone companies and government agencies have different service boundaries and types of information. The second section outlines the procedure for developing a database for E9-1-1, which is a handbook detailing needed data and the process for bringing it together. It was designed to be used in a case study for an Oregon county. Section three includes three short pamphlets which summarizes in lay terms some of the issues discussed in the first two sections. The major concern addressed in the report is the development of a database by which the street address of a caller to an emergency dispatch system is linked to the appropriate emergency service zone. The development of a master street address guide is necessary for computer-aided dispatch, and Census Bureau TIGER line files are being used to develop the necessary data to support E9-1-1.

Paper

Linking a Mainframe DB2 Database to Workstation Graphics at the Oregon Department of Transportation, Levy, Chris A., Department of Transportation, AASHTO GIS for Transportation Symposium, March 6-8, 1991, Orlando, Florida, 1991.

This paper describes how the Oregon Department of Transportation (DOT) is linking the state's road inventory database on DOT's IBM mainframe and transportation graphics files within an Intergraph CAD system. Road inventory data are being converted for transfer to the IBM's DB2 relational database. It was decided that the mainframe and graphics systems would be kept separate, yet linked together by highway and milepost numbers to generate graphics when needed. Analysis is performed on the mainframe and summarized for display on the graphics system. The application was written in-house.

Using GNIS at the Oregon Department of Transportation, Meacham, James E., et al., Mapping and Mileage Control Unit, Department of Transportation, 1991.

This paper describes how the Oregon Department of Transportation has developed a procedure for the automated placement of text from the Geographic Names Information System (GNIS) into an Intergraph computer graphics file. These graphics are used for the production of the General Highway County Map Series. The procedure makes use of an IBM mainframe computer as the primary storage device for the complete version of the GNIS file for Oregon. An Intergraph VAX minicomputer with graphics workstations are used for computer mapping. Data sets created from the GNIS by county feature type and are then transferred by direct link to the VAX. This method has saved much time in production by eliminating much of the keying-in and research needed in annotating the maps.

Brochure

Oregon GIS User Reference Guide, State Map Advisory Council, GIS Committee, January, 1988.

This brochure includes information about contacts, hardware, software, coverage and data themes of state, federal, local and other GIS users in the state. This information is also available in the state library's on-line Public Access Catalog.